第28卷 第3期 古脊椎动物学报 pp. 206—217
1990年7月 VERTEBRATA PALASIATICA figs. 1—5

双尖齿兽科[1)]（Didymoconidae）一新种及有关地点地层问题

孟 津
（中国科学院古脊椎动物与古人类研究所） （美国纽约哥伦比亚大学地质系）

关键词 内蒙古马捷茨营地 古双尖齿兽

内 容 提 要

本文记述了内蒙古二连盆地"马捷茨营地"(Camp Margetts) 地区中始新世阿山头组产出的一种古双尖齿兽：*Archaeoryctes borealis* sp. nov.。该种为中国北方及中亚一带已知双尖齿兽科中形态最为原始、出现时代最早的分子。它使中国南方早期的双尖齿兽科成员与北方较晚期的成员建立了某种关系。文中对与该种产出地点及地层有关的问题进行了讨论。

一、前 言

在美国自然历史博物馆中亚考察队采集的双尖齿兽标本中，有一件保存不十分好的下颌标本（AMNH 80794)。在众多未被描述过的标本中，该件下颌代表了一种较原始的类型 *Archaeoryctes borealis* sp. nov.。该种除了在形态上的一些原始特征外，其产出地点和层位也是一有趣的问题。由于中亚考察队所做的工作经年已久，而近年来二连盆地一带地层古生物工作的新发现和研究进展，使有关的地点、地层问题变得较为复杂。

1988年7月，本文作者与中国科学院古脊椎动物与古人类研究所的叶捷、王元青先生在 AMNH 80794 标本的产出地"马捷茨营地"及其附近的地点进行了一些野外地层观察。在室内研究过程中，作者仔细查阅了中亚考察队在内蒙古野外考察时留下的野外笔记。对照近年来的一些研究报告以及我们的野外观察，对马捷茨营地地点、地层问题提出一些看法。

作者对中国科学院古脊椎动物与古人类研究所的翟人杰、李传夔、齐陶及郑家坚先生对野外工作所做的安排以及对有关地层问题的讨论表示衷心的感谢；对叶捷、王元青先生在野外工作中的帮助表示特别的感谢。美国自然历史博物馆的 M. C. McKenna 和 M. J. Novacek 博士对本文的形成提出意见，并准许使用和研究他们管理下的标本，作者对他们表示感谢。本文的研究项目由纽约哥伦比亚大学地质系奖学金以及美国自然历史博物馆卡特野外基金资助。

---

1) 双尖齿兽也有译为对锥齿兽(郑家坚，1979)，但前者出现较早，使用较多。

二、标 本 记 述

目未定 Mammalia, Order indet.

双尖齿兽科 Didymoconidae Kretzoi, 1943

古双尖齿兽 *Archaeoryctes* Zheng, 1979

北方古双尖齿兽 *Archaeoryctes borealis* sp. nov.

(图 1)

正型标本 具完整 P_4 和破损 M_{1-2} 的右下颌，AMNH 80794。

产地与层位 中始新世，阿山头组，马捷茨营地以西 (235°) 约 11 公里 (7 英里) 处。

种名由来 *Boreus* (拉)，北方的，与南方古双尖齿兽相对。

种的特征 个体小；P_4 未臼齿化，具有纵脊形跟座；臼齿下前尖较大，靠近舌侧；下次尖突出；下次小尖紧靠下次尖后内侧；无下内尖，跟座因此而呈舌侧开阔的盆形。

描述 下颌角与垂直支以及 P_3 齿槽前下颌部分均未保存。水平支较浅，从唇侧测量，M_2 下深 6 毫米，P_4 下深 5 毫米。后颏孔位于 P_3 后齿根外侧。P_3 未保存，其后齿根齿槽表明 P_3 后齿根粗壮，也有可能为一单齿根。P_4 保存完好，未臼齿化。主尖侧向扁，具刃状纵脊。跟座脊形，与主尖以一浅裂相隔。

M_1 三角座破损，但跟座保存完好。次尖明显，与下原尖以一低的次尖脊相连接。齿的最后端为一磨蚀面，但仍可辨认出下次小尖的存在。下内尖很可能不存在，但因磨蚀面的缘故而不能确认。跟座盆形。

M_2 下原尖与下后尖破损，从横断面上判断，该两尖已近于对生，但没有明显膨大。下前尖明显，位于齿的近舌侧，与下原尖以一近横向的脊相连。跟座保存完好，窄长，具一突出的下次尖，与下原尖以纵脊相连。下次小尖明显，紧靠下次尖后内侧，位于齿的最后端点。下内尖未发育。盆形跟座舌侧呈开放形。

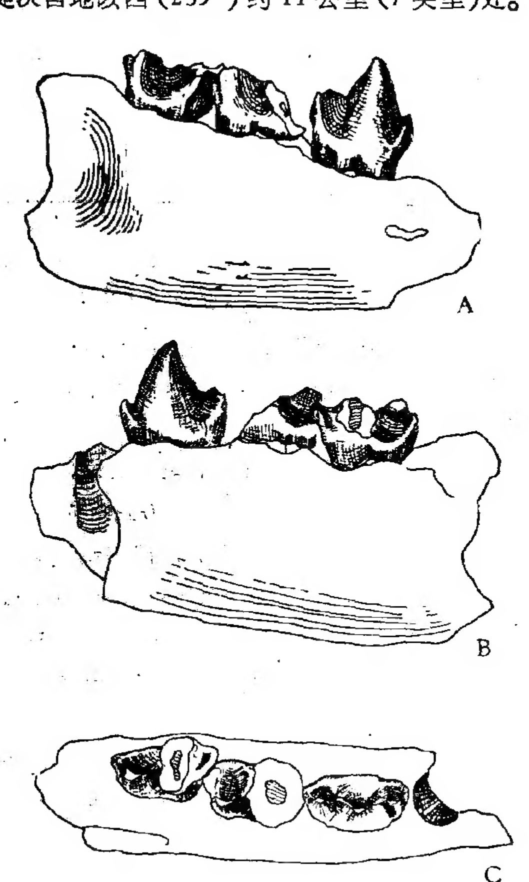


图 1　*Archaeoryctes borealis* sp. nov.
右下颌，正型标本 (AMNH 80794)，A：唇面视；B：舌面视；C：冠面视

Fig. 1　Right low jaw, holotype (AMNH 80794); A, B and C: labial, lingual and occlusal view

比较与讨论 新种因 M_3 不发育以及颊齿与 *Archaeoryctes notialis* Zheng, 1979 的相似性而被鉴定为双尖齿兽科的成员。在已知双尖齿兽科的各属种中,新种与 *A. notialis* 最为接近。两者 P_4 都呈刃状,具一纵脊形跟座;臼齿下前尖明显,靠近舌侧,与不太强壮的下原尖、下后尖构成一较原始的下三角座;臼齿下内尖不发育,跟座因此在舌侧呈开放形。两者都具有一些双尖齿兽中较原始的特征。新种与 *A. notialis* 的主要区别在于个体大小相差明显(见表 1)。

表 1 *Archaeoryctes* 下牙测量(单位:毫米)

Table 1 measurements of *Archaeoryctes* (in mm)

	A. borealis		*A. notoalis* (from Zheng, 1979)	
	W	L	W	L
P/4	1.8	3.5	2.5	5.0
M/1	2.1	3.5	2.9	5.1
M/2	2.0	3.5	3.5	5.6
P/4-M/2		10.5		15.7

新种与 *Didymoconus* Matthew et Granger, 1924 中的各个已知种很容易区别。在 *Didymoconus* 中,P_4 已臼齿化,即三角座已发育有横向对生的锥状下原尖和下后尖,尽管有的标本中该对齿尖还未完全分开;在下臼齿与 P_4 上,下内尖都很发育,与突出的下次尖构成另一对较矮的对生齿尖,位于下原尖与下后尖后;下前尖小而低,位于齿的纵轴线上。

在 *Ardynictis* Matthew et Granger, 1925 一属中,dP_4 臼齿化,但 P_4 仍未臼齿化。与 *Archaeoryctes* 不同的是,*Ardynictis* 的 P_4 主尖高且呈锥形,没有刃状的纵脊,而且跟座为低的横脊;臼齿下前尖与跟座都更为退化;没有下次小尖,表现出较为进步的特征。

在南方发现的材料中,意外湖南兽 *Hunanictis inexpectatus* Li et al., 1979 是另一个能确认为双尖齿兽的分子。在正在研究的标本中(丁素因等),产自湖北均县玉皇顶组的一个头骨标本,也可能为双尖齿兽科的成员。但这些类型都未保留下颌标本,故无法进行对比。

A. borealis 在中国北方及中亚一带发现的双尖齿兽科已知成员中,形态最原始,产出时代也最早。在阿山头动物群(齐陶,1979,1987)中也是首次记录。该种的发现,使南方的早期双尖齿兽科成员与北方较晚期的成员建立了某种联系,支持了郑家坚(1979)提出的古双尖齿兽与阿尔丁兽和双尖齿兽较为接近的看法。新种很可能代表了北方晚期双尖齿兽的祖先类型,而 *A. notialis* 则可能距主枝较为远一些,因为后者个体已相当大。

从已知材料来看,双尖齿兽类很可能起源于中国南方,而在晚始新世后,尤其在渐新世时变得较为繁盛。从南方到北方的迁移大约是在中始新世,*A. borealis* 为此提供了证据。

三、有关地点和地层评述

AMNH 80794 是 1930 年由中亚考察队在“马捷茨营地”以西(235°)约 11 公里(7 英里)处采到。根据野外记录，标本产自该地点 “Irdin Manha Formation”。关于马捷茨营地这个地点以及该地点地层的划分需要进行一些说明。

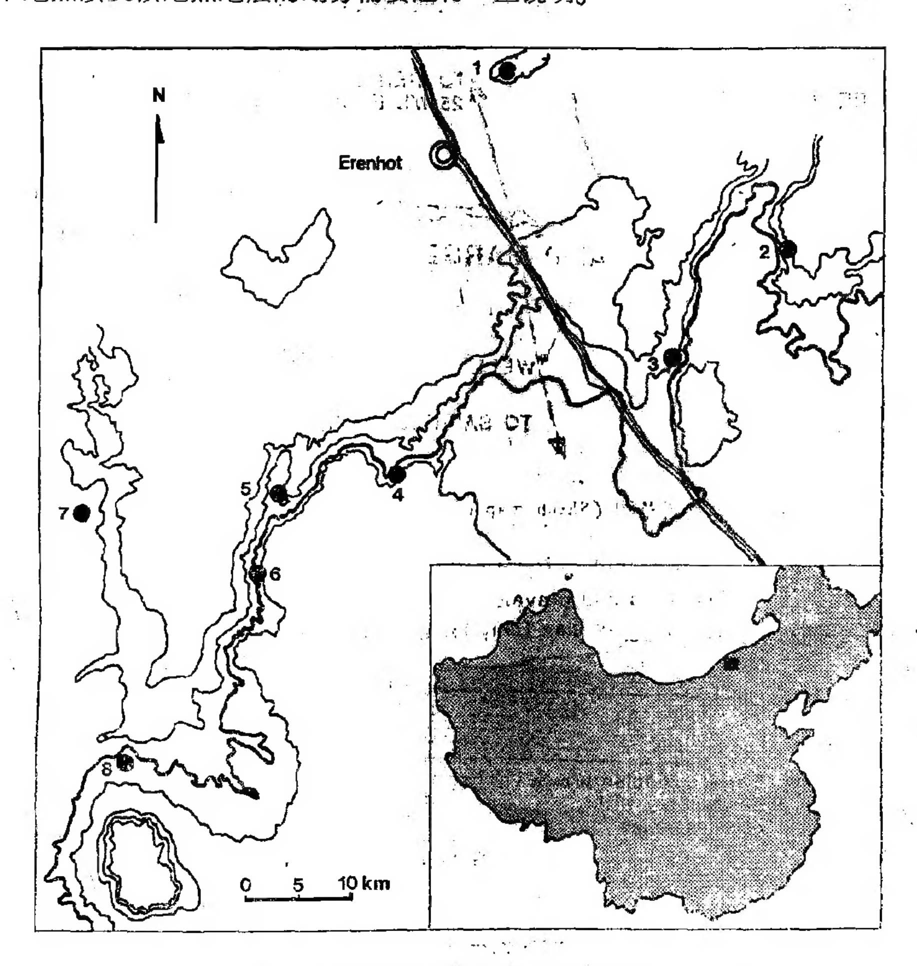


图 2　马捷茨营地地区及邻近地点地形图

1：二连盐池(二连大巴苏)；　2：阿山头组典型地点；　3：伊尔丁曼哈组典型地点；　4：马捷茨营地 (靠近现在的都和敏勃尔和)；　5+6：呼和勃尔和 (乌兰博尔和+呼和勃尔和)；　7：毛登公社(额仁淖尔)；　8：巴颜乌兰地区

Fig. 2. Topographical map of Camp Margetts area and localities in its vicinity
1: Irlien salt-lake (Iren Dabasu);　2: type locality of the Arshanto F.;　3: type locality of the Irdin Manha F.;　4: Camp Margetts (in vicinity of today's Duheminborhe);　5 + 6: Huhoborho (Huhe Bulak);　7: Maodeng commune (Eren Nor);　8: Bayan Ulan

地点　1923 年 5 月 5 日，Granger 和 Morris 于一次踏勘中在距二连大巴苏 (现在

的二连盐池，见图 2）西南 25 英里陡坎上的砂砾岩中采到一些保存不好的哺乳动物化石（Morris, 1923, 野外记录 II, 第 75 页)。1930 年，中亚考察队又回到这一地点，并建立了马捷茨营地 (Camp Margetts)。马捷茨营地也就被用来作为地点名称，延用至今。Radinsky (1964) 认为该营地位于 1923 年旧地点以南几英里的地方。最近的研究报告中，齐陶(1980,1987; Russell and Zhai, 1987) 认为马捷茨营地位于呼和勃尔和（乌兰布拉克，齐陶，1987）陡坎一带。齐陶(1987)同时指出，1930 年在马捷茨营地以西和西南

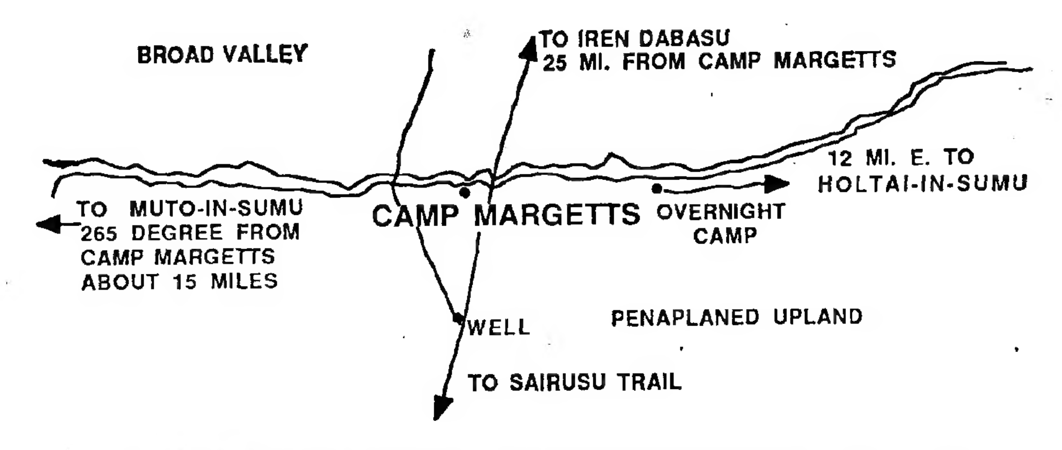


图 3 马捷茨营地位置草图 (Skech map of Camp Margetts) (Granger, 1930, p.22)

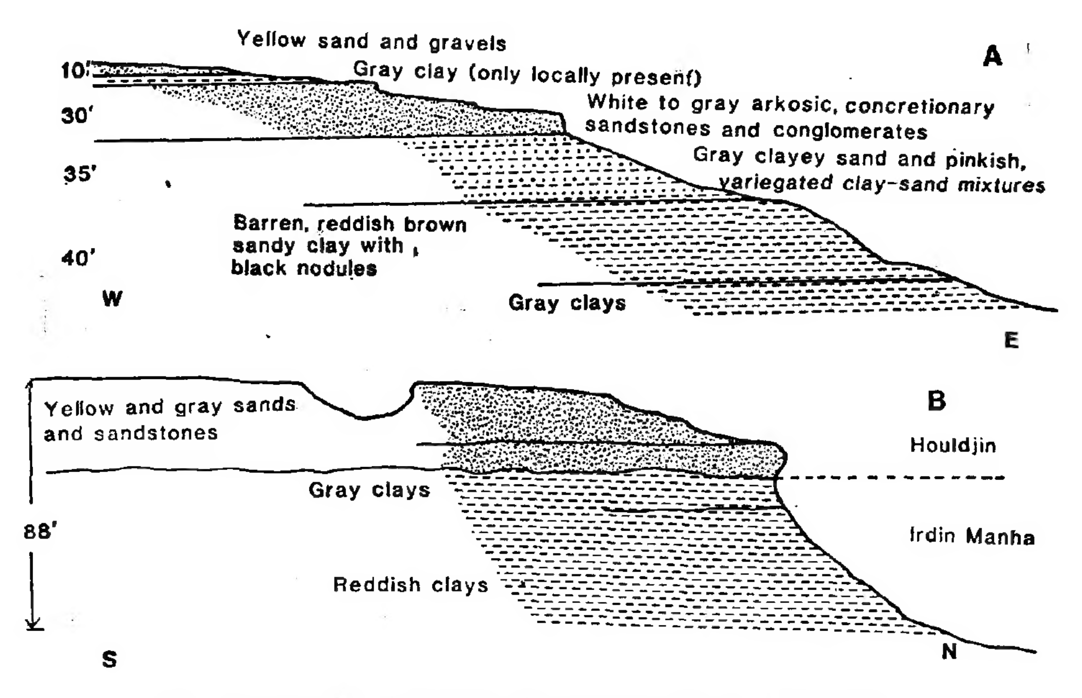


图 4 A: 1923 年地点剖面草图 (Morris, 1923, p.79); B: 马捷茨营地剖面图 (Granger, 1930, p.43)

Fig. 4. A: Profile at the locality in 1923; B: Camp Margetts section

发现的一些地点，可能位于巴颜乌兰一带。但实际上，呼和勃尔和以西 10 公里（6 或 7 英里)处，是现在毛登公社(额仁淖尔)以东的低地，没有第三系出露。因此，马捷茨营地位于呼和勃尔和陡坎的看法值得怀疑。以下几点理由支持这一怀疑。

1. 根据野外记录和地形草图（Granger, 1930, 化石记录；Morris, 1923, 野外记录 II, 第 76 页)，马捷茨营地的位置都标在面向北的陡坎边缘上（图 3)，位于二连盐池南南西约 40 公里（25 英里)处。这个距离和方向与现在的二连盐池到都和敏勃尔和一带陡坎的距离、方向相吻合。

2. 1923 年的地点在车道西边的陡坎上。当时做的一个剖面图面向东（Morris, 1923, 第 79 页)(图 4A)。Granger（1930，第 43 页)做的马捷茨营地剖面(图 4,B) 则面向北。如果马捷茨营地位于呼和勃尔和一带，则上述情况都几乎不可能出现。与此相反，Granger（1930，第 38、51 页)做的马捷茨营地以西约 11 公里（7 英里）和西南 16 公里（10 英里)处的剖面都面朝西(图 5)，它们位于呼和勃尔和一带的可能性极高。

3. Granger 做的马捷茨营地剖面，与我们在都和敏勃尔和一带观察到的剖面基本一

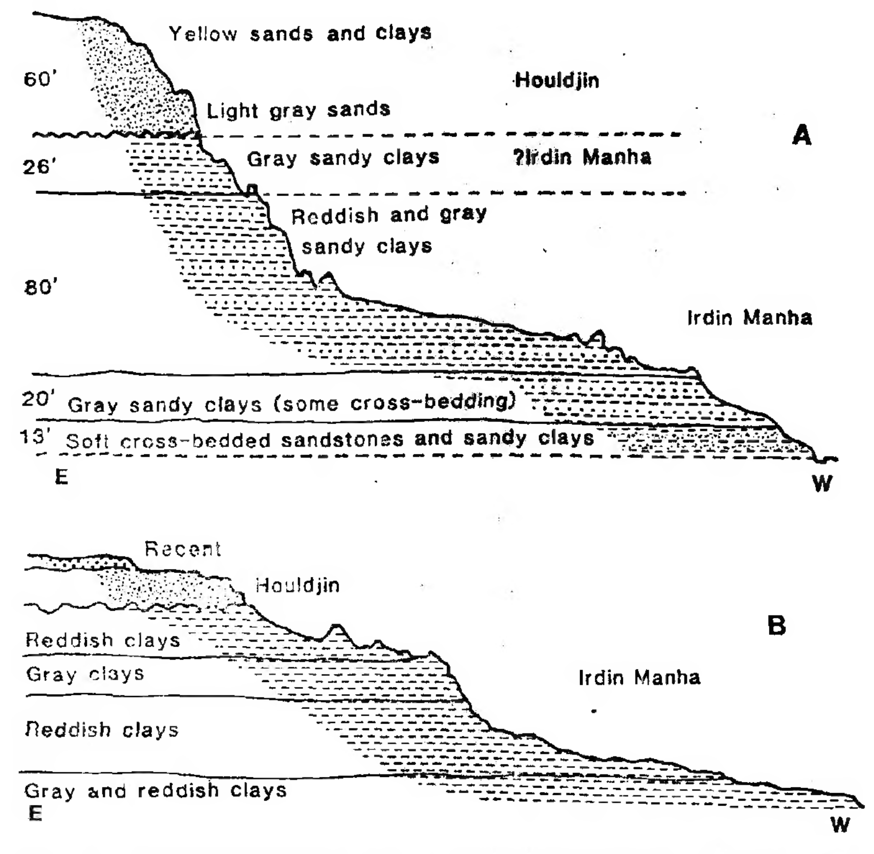


图 5　A：马捷茨营地西南 10 英里地点剖面；B：马捷茨营地西边 7 英里地点剖面
(Granger, 1930, pp. 51,38)

Fig. 5.　A: Profiles of the escarpments 10 miles southwest of Camp Margetts; and B: 7 miles west of Camp Margetts

致，都以上部的黄色砂砾岩为主和下部红色泥岩为主的岩层构成（图 4)。而在马捷茨营地以西或西南一带的剖面，则较为复杂(图5)，与我们在呼和勃尔和观察到的情况一致，也与已发表的该陡坎的剖面（江浩贤，1983；齐陶，1987）相近似。

4. 在马捷茨营地一带所做的剖面(如图 5)，在巴颜乌兰一带没有与之对应的露头，也无法与巴颜乌兰剖面相对比。

根据以上几点理由，笔者认为马捷茨营地应位于现在的都和敏勃尔和一带的陡坎边缘上，非常接近 1923 年的地点，而不是在后者以南若干英里处。而马捷茨营地以西约 10 公里（6 或 7 英里)，以及其西南 16 公里（10 英里)处的若干地点，应位于呼和勃尔和一线的陡坎处而不是在巴颜乌兰地区。

马捷茨营地应当是确指在都和敏勃尔和附近的一个点而不是一个区域。但 1930 年的其它地点都以马捷茨营地为参照点，因此笔者建议用马捷茨营地地区来泛指由都和敏勃尔和一带面向北的陡坎及呼和勃尔和一带面向西的陡坎所围成的区域。

地层划分 Radinsky (1964) 提到，中亚考察队在马捷茨营地地区做的四个剖面 (Morris, 1923, 第 79 页；Granger, 1930, 第 38、43、50 页)互不相同(图 4，5)。但大体上看，它们都是以上部的一套砂砾岩和下部的一套泥质岩为主构成的。在当时的记录 (Granger, 1930) 以及后来的文章中，上部的砂砾岩都被认为是“Houldjin”，而下部的泥岩则被认为是“Irdin Manha Formation”。在评述马捷茨营地地区的地层问题时，Radinsky (1964) 曾指出过，下部的泥岩与典型的阿山头组更为相似。齐陶（1980）明确提出在马捷茨营地地区存在阿山头组和下始新统巴颜乌兰组。而顶部的砂砾岩则自然地被确认为伊尔丁曼哈组。

在最近的研究报告中，有关阿山头，伊尔丁曼哈及其相邻层位的划分又出现不同的看法。齐陶（1987）认为传统的阿山头组 (Berkey et Morris, 1924, 1927) 包含了上部的阿山头层和下部的脑木根组，后者由巴颜乌兰层和脑木根层组成。齐陶将阿山头层与上部的伊尔丁曼哈层合并而构成为一重新定义的伊尔丁曼哈组，时代为中始新世，而将阿山头组这一地层名称废弃。其他人的文章中（江浩贤，1983；Russell et Zhai, 1987）则仍然使用了阿山头组这一概念，与伊尔丁曼哈组并存。但江认为伊尔丁曼哈(＝阿力乌苏)组为上始新统，而 Russell 等则认为是中始新统。

笔者认为马捷茨营地地区至少存在伊尔丁曼哈和阿山头两套地层这一看法是有根据的，而原中亚考察队的划分欠妥，即原中亚考察队提出的“Houldjin”和“伊尔丁曼哈”大体上相当于现在的伊尔丁曼哈与阿山头。但笔者不同意将“阿山头层”与“伊尔丁曼哈层”合并为伊尔丁曼哈组的看法，其理由如下。

1. 在伊尔丁曼哈组、阿山头组的典型地点和马捷茨营地地区北缘的陡坎一带（图 4)，以及在巴颜乌兰地区，这两套地层的岩性都明确可分，而且存在平行不整合面。在呼和勃尔和一带，地层情况变得比较复杂，有可能是局部沉积环境不同造成的某种相变。但上部粗且较为松散的砂砾岩和下部泥岩为主的基本格局仍可辨认（图 5)。因此，这两套地层岩性上的不同从整体上看是明显的。

2. 与上述情况相反，阿山头层与其下的脑木根组则在岩性上更为相似，脑木根组以红色泥岩为主(周明镇等，1976)。尽管在脑木根层中含有天青石团块(江浩贤，1983；齐

陶，1987），脑木根层与阿山头层之间的巴颜乌兰层（组）也基本上没有明显的地层岩性特征，而仅是根据哺乳动物化石可能存在的一些差别而建立的（江浩贤，1983）。因此，阿山头层与脑木根组的岩性差别应小于与伊尔丁曼哈层的差别。

3. 此外，"伊尔丁曼哈层"的概念本身也不明确。在齐陶（1987）的文章中，该层不仅包含了传统的伊尔丁曼哈组，而且在巴颜乌兰地区，还包含了其上覆的一套27米厚的红色泥岩层。该套红色泥岩层被认为是沙拉木伦层，它与下伏的伊尔丁曼哈层构成阿力乌苏组（江浩贤，1983）。而Russell 等（1987）则认为在内蒙地区，未见到沙拉木伦覆于伊尔丁曼哈之上的情况。由此可见，"伊尔丁曼哈层"实际上指不同的东西，含义不清。

根据以上理由，本文仍使用传统的伊尔丁曼哈概念。在传统的阿山头组中，充其量可以根据天青石团块的存在而划分出一脑木根层，但"巴颜乌兰层"的划分则缺乏岩性根据。因此，本文暂时将不含天青石团块的部分理解为阿山头组，并确认 AMNH 80794 标本产自马捷茨营地地区呼和勃尔和陡坎靠北的部分，层位是中始新世阿山头组。该标本形态上的原始性，支持了阿山头动物群时代较伊尔丁曼哈动物群早的看法（齐陶，1987）。它可能代表了中亚一带较晚期双尖齿兽科成员的祖先类型。

（1989 年 3 月 17 日收稿）

参 考 文 献

齐陶，1979：内蒙古沙拉木伦地区早第三纪哺乳动物概述。全国第二届地层会议材料。

——，1980：内蒙古呼和勃尔和陡坎晚始新世伊尔丁曼哈层及其哺乳动物群。古脊椎动物与古人类，18(1)，28—32。

——，1987：内蒙中始新世阿山头动物群（原文为英文）。*Annals of Carnegie Museum*, 56(1), 1—73。

江浩贤，1983：内蒙古二连盆地老第三纪地层的划分。内蒙古地质，1983 年第二期。

李传夔、邱占祥、阎德发、谢树华，1979：湖南衡阳盆地早始新世哺乳动物化石。古脊椎动物与古人类，17(1)，71—80。

周明镇、齐陶、李荣，1976：内蒙古四子王旗晚古新世地层及哺乳动物群的性质与对比。古脊椎动物与古人类，14(4)，228—233。

郑家坚，1979：江西古新世对锥齿兽科（Didymoconidae）一新属。华南中、新生代红层。科学出版社，360—365。

Berkey, C. P. and F. K. Morris, 1924: Basin structure in Mongolia. *Bull. Amer. Mus. Nat. Hist.*, 51(5), 103—127.

————, 1927: Geology of Mongolia. Natural history of central Asia, vol. 2, 1—475. New York, the American Museum of Natural History.

Granger, W., (MSS.): Records of fossils collected in Mongolia in 1923, 1925, 1928, and 1930. New York, the American Museum of Natural History.

Matthew, W. D. and W. Granger, 1924: New Carnivora from the Tertiary of Mongolia. *Amer.* Mus. *Novitates*, 104, 1—9.

————, 1925: New creodonts and rodents from the Ardyn Obo Formation of Mongolia. *Amer. Mus. Novotates*, 193, 1—7.

Morris, F. K., (MSS.): Geological field notes, Central Asiatic Expeditions of 1923 and 1925. New York, the American Museum of Natural History.

Radinsky, L. B., 1964: Notes on Eocene and Oligocene fossil localities in Inner Mongolia. *Amer. Mus. Novitates*, 2180, 1—11.

Russell, D. E. and R-j., Zhai, 1987: The Paleogene of Asia: mammals and stratigraphy. *Mem. Mus. Nat. D'Hist. Nat.*, serie C, Sciences de la terre, tome 52, 1—488.

A NEW SPECIES OF DIDYMOCONIDAE AND COMMENTS ON RELATED LOCALITY AND STRATIGRAPHY

Meng Jin

(Department of Geology, Columbia University, New York)

(Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica)

Key words Camp Margetts, Nei Mongol; Didymoconidae

Summary

A small didymoconid, *Archaeoryctes borealis* sp. nov., is described. The specimen was collected from the Middle Eocene Arshanto Formation at Camp Margetts area, Nei Mongol in 1930 by the Central Asiatic Expedition Team from the American Museum of Natural History (AMNH). The new species represents the earliest and most primitive didymoconids known in the central Asiatic area. It links the even earlier didymoconids from south China to their later central Asiatic members. Discussion about the locality and stratigraphy associated to the specimen is presented, which is developed mainly on the author's field observation in July, 1988, and the field notes made by the Central Asiatic Expedition.

I am grateful to R. -j. Zhai, C. -k. Li, T. Qi and J. -j. Zheng (IVPP) for arranging the field work and introducing me the stratigraphy of Erhlien basin, Nei Mongol. Particularly, I thank J. Ye and Y. -q. Wang (IVPP) for their help during the field work in Nei Mongol. I also thank Drs. M. C. McKenna and M. J. Novacek (AMNH) for encouraging and supporting me throughout the course of this study and for permitting the study of the specimens under their care. This subject is supported by a faculty fellowship from Columbia University and by the James Carter Memorial Fund (AMNH).

Systematics

Mammalia, order indet.

Didymoconidae Kretzoi, 1943

***Archaeoryctes* Zheng, 1979**

***Archaeoryctes borealis* sp. nov.**

(Figure 1)

Holotype A right mandible with P_4 and incomplete M_1 and M_2, AMNH 80794.

Age and Locality Middle Eocene Arshanto Formation, 7 miles southwest (235 degree) from the Camp Margetts, Nei Mongol.

Etymology *Boreus* (Latin), northern, in reference to the geographic distribution of this species.

Diagnosis Small in body size; lower P_4 nonmolariform, with longitudinal trenchant heel; paraconids on molars large, lingually located; hypoconid distinctive; hypoconulid posteromedial to the hypoconid; entoconids not developed; and talonid open lingually.

Description Mandible is shallow and measured 6.0 mm under M_2 and 5.0 mm under P_4 from the labial side. The posterior mental foramen is on the lateral side of the posterior root of P_3. P_3 is gone; its alveoli indicates a very strong posterior root. P_4 is nonmolariform, with a sharp anterior cusp anteromedial to the main cusp which is transversely compressed. The heel is trenchant, with a distinct hypoconid and a very small cusp at its posterior end, which may be identified as the hypoconulid.

The trigonid of M_1 is broken but talonid is well preserved. The hypoconid is large, sending a low ridge anteriorly to the posterior side of the protoconid. The hypoconulid is present although heavily worn. The entoconid is probably not developed.

Both the protoconid and metaconid of M_2 are gone. They are very likely twin-cusps but not greatly expanded. The paraconid is large, more lingually located, and posterolaterally connected with the protoconid by a low ridge. The talonid is narrow, with a predominant hypoconid. The hypoconulid is posteromedial to the hypoconid, occupying the most posterior end of the teeth. The entoconid is not present and thus the talonid is lingually wide open. As in other didymoconids, M_3 is not developed.

Discussion AMNH 80794 is most similar to *Archaeoryctes notialis*; both share some primitive didymoconid features, such as blade-shaped P_4 with trenchant heel; the paraconid of molars large and lingually located; and the entoconid not developed. These two species differ mainly in size (Table 1).

Species of *Didymoconus* differ from *A. borealis* in having a molariform P_4, distinctive entoconids on molariform teeth, and small paraconid resting on the longitudinal axis of molariform teeth.

The lower P_4 of *Ardynictis* is nonmolariform, but its main cusp is cone-shaped and very high. The paraconid and talonid of the molars are greatly reduced, in contrast to the expanded protoconid and metaconid. In addition, the hypoconulid is not observed in *Ardynictis*.

A. borealis is the first record of didymoconid in the Arshanto Fauna (Qi, 1979, 1987). It is the earliest and most primitive form in the known didymoconids from the central Asiatic area. The new species suggests certain relationship between the early didymoconids of the south China and the later central Asiatic ones. *A. borealis* may represent the ancestral morphotype which gave rise to the later northern didymoconids. This seems supporting the idea that *Didymoconus* and *Ardynictis* are more closely related to *Archaeoryctes* (Zheng, 1979).

Comments on Locality and Stratigraphy

Locality AMNH 80794 was collected at a site 7 miles, 235 degrees (SW) from Camp Margetts by the Central Asiatic Expeditions in 1930. In 1923, Granger and Morris collected some moderate mammal fossils at an escarpment 25 miles southwest Iren Dabasu (Fig. 2). Seven years later, the Expedition returned to the same area and set up a base named 'Camp Margetts.' Camp Margetts has been used as a locality name thereafter. A few other localities found in 1930 were named by referring to Camp Margetts, such as 7 miles, 235 degrees from and 10 miles southwest of Camp Margetts. Unfortunately, confusion is obviously present today about where Camp Margetts was located. Radinsky (1964) believed that Camp Margetts was a few miles south of the 1923 locality, but he failed to locate the latter. Recent belief is that Camp Margetts

lies on the Huheborho (Huhe Bulak) escarpment (Qi, 1980, 1987; Russell and Zhai, 1987) (Fig. 2). Qi (1987) further pointed out that localities west or southwest to Camp Margetts may extend to include the Bayan Ulan area (Fig. 2). According to my observation, however, a few miles west or southwest to the Huheborho escarpment and east to today's MaoDeng Commune (Eren Nor) is a low land exposing no Tertiary beds. The following evidences also support that Camp Margetts is not located on the Huheborho escarpment.

1. Sketch maps (Morris, 1923; Granger, 1930) show that Camp Margetts lies on the edge of an escarpment facing north, about 25 miles south southwest of Iren Dabasu (Fig. 3). The direction and distance indicate that Camp Margetts should be somewhere around today's Duhemin Borhe (Fig. 2).

2. The 1923 locality is at the west of the road which comes down in a direction north northeast to the locality. The crossection made at this locality faces east (Morris, 1923, p. 79) (Fig. 4A). The Camp Margetts profile made by Granger (1930, p. 43) faces north (Fig. 4B). These situations are hardly to be true if Camp Margetts lies on the Huheborho escarpment that faces west. In contrast, profiles made at the localities 7 miles west and 10 miles southwest of Camp Margetts face west (Fig. 5). They are more likely along the Huheborho escarpment.

3. Lithology of Camp Margetts section (Fig. 4B) is almost the same as the sequence that we observed at Duhemin Borhe, i.e., lower reddish clay capped by yellow sandstones. On the other hand, lithology of the sections west and southwest of Camp Margetts is more complicated (Fig. 5), which is similar to what we saw along the Huheborho escarpment, and similar to the sections of the same escarpment published by others (Jiang, 1983; Qi, 1987).

4. Sections west and southwest Camp Margetts (Fig. 5) do not fit any exposures in Bayan Ulan area according to my observation, nor readily correlate to the Bayan Ulan section (Jiang, 1983; Qi, 1987).

Because of these reasons, it is believed that Camp Margetts as a site is very close to the 1923 locality and both are on the edge of the escarpment around today's Duhemin Borhe (Locality 4 in Fig. 2). Other localities west and southwest of Camp Margetts are located along the Huheborho escarpment, instead of the Bayan Ulan area. To avoid confusion, 'Camp Margetts Area' is suggested to include the area bounded on the north by the Duhemin Borhe escarpment and on the west by the Huheborho escarpment.

Stratigraphy Radinsky (1964) mentioned that all the four sections from Camp Margetts area do not agree exactly with each other (Figs. 4, 5). Although differences are present, the four sections generally include clays at the bottom and course sandstones on the top. The upper sandstones were then referred to as "Houldjin Formation" while the lower clays as "Irdin Manha Formation" (Figs. 4, 5). AMNH 80794 was labelled as coming from the "Irdin Manha Formation." Radinsky (1964) pointed out that the lower clays exposed at Camp Margetts area were lithologically more similar to the type Arshanto beds than to the Irdin Manha. Furthermore, Qi (1980) proposed a threefold division of the sequence at Camp Margetts area; Irdin Manha beds, Arshanto and Bayan Ulan formation, ranging from top to bottom.

More recently, Qi (1987) rearranged some of these rock units. He suggested that the classic Arshanto Formation (Berkey and Morris, 1924, 1927) consists of Arshanto beds on the top and Nomogen Formation at the bottom. The latter is further divided into the upper Bayan Ulan beds and the lower Nomogen beds. He combined the Arshanto and Irdin Manha beds into the Irdin Manha Formation of middle Eocene, and abandoned the Arshanto Formation.

Others (Jiang, 1983; Russell and Zhai, 1987), however, still regarded the Arshanto Formation as a valid rock unit.

In Camp Margetts area, recognition of both Arshanto and Irdin Manha is agreed according to my observation. The Irdin Manha is roughly equivalent to the "Houldjin" of the Expedition, while the Arshanto is equivalent to the "Irdin Manha". Lithologically, this is acceptable. However, the combination of the "Arshanto beds" and "Irdin Manha beds" into a redefined Irdin Manha Formation is supported by little evidence and is disagreed hereby. The reasons are as follows.

1. The Arshanto and Irdin Manha Formation are lithologically distinctive at their type localities, at the north border of the Camp Margetts area, and at the Bayan Ulan area. The former is mainly reddish clays and the latter is yellow sandstones and both are separated by a disconformity. Although the Huheborho escarpment presents more complicated rock sequences (Fig. 5), this may be a result of local facies change. Nevertheless, the major plan that coarse sandstones lie on the top and clays rest at the bottom is still recognizable, and disconformity is also recorded between these two units in these sections.

2. Lithologically, the "Arshanto beds" are obviously more similar to the underlying Nomogen Formation than to the Irdin Manha. The Nomogen Formation is mainly reddish clays (Chow et al., 1976). Although the Nomogen beds may possibly be identified by its celestite-nodule content, the Bayan Ulan beds (or formation) are merely based on the Bayan Ulan Fauna (Jiang, 1983), which shows slight difference to the Nomogen Fauna and therefore the "Formation" is not lithologically defined.

3. Finally, the concept of "Irdin Manha beds" itself is unclear. Qi's (1987) "Irdin Manha beds" include the classic Irdin Manha Formation and a set of reddish clays overlying it in the Bayan Ulan area. This set of reddish clays is 27 meters thick and believed to be "Shara Murun beds" (Jiang, 1983). Jiang placed the "Shara Murun beds" and its underlying "Irdin Manha beds" (= classic Irdin Manha Formation) into the Aliusu Formation. Others (Russell and Zhai, 1987) held that the Shara Murun overlying Irdin Manha is a situation not observed in Nei Mongol. Apparently, "Irdin Manha beds" means different rock units in the usage of various authors.

Because of these reasons, it seems better to retain the classic Irdin Manha Formation. The Nomogen beds (or Formation) can at most be separated from the classic Arshanto Formation based on the celestite-nodules, but the "Bayan Ulan beds" (or formation) calls on no lithological evidence. The Arshanto Formation is tentatively understood hereby as the classic sequence but without including the lower portion containing celestite-nodules.

It is concluded that AMNH 80794 came from the Middle Eocene Arshanto Formation of the Huheborho escarpment, Camp Margetts area. The primitive nature of this specimen supports the idea that the Arshanto fauna is earlier than the Irdin Manha fauna (Qi, 1987).